



213131

WHAT IS CLAIMED IS:

1. A liquid crystal display comprising:

- a substrate;
- a pixel electrode on said substrate;
- a pixel isolator surrounding said pixel electrode, said pixel isolator being formed by an insulator;
- a liquid crystal layer on said pixel electrode surrounded by said pixel isolator;
- a common electrode on said liquid crystal layer; and
- a counter substrate on said common electrode.

2. A liquid crystal display comprising:

- a substrate;
- a pixel electrode on said substrate;
- a pixel isolator surrounding said pixel electrode, said pixel isolator being formed by an insulator;
- a first connection electrode on said substrate and insulated from said pixel electrode;
- a second connection electrode on said substrate and insulated from said pixel electrode and said first connection electrode;
- a first liquid crystal layer on said pixel electrode and surrounded by said pixel isolator;
- a first transparent electrode on said first liquid crystal layer and surrounded by said pixel isolator, said first transparent electrode being electrically connected to said first connection electrode;

FOR INFORMATION
DISCLOSURE
PURPOSES ONLY

Related Pending Application
Related Case Serial No: 09/960,489
Related Case Filing Date: 09/24/01

a second liquid crystal layer on said first transparent electrode and surrounded by said pixel isolator;

a second transparent electrode on said second liquid crystal layer and surrounded by said pixel isolator, said second transparent electrode being electrically connected to said second connection electrode;

a third liquid crystal layer on said second transparent electrode;

a common electrode on said third liquid crystal layer; and

a counter substrate on said common electrode.

3. A liquid crystal display according to claim 2,

wherein one of said first liquid crystal layer, said second liquid crystal layer and said third liquid crystal layer comprises liquid crystal microcapsules.

4. A liquid crystal display according to claim 2,

wherein one of said first liquid crystal layer, said second liquid crystal layer and said third liquid crystal layer comprises liquid crystal suspended in a solid layer.

5. A liquid crystal display according to claim 2, further comprising:

a pixel switch element connected to said pixel electrode;

a first switch element connected to said first connection electrode; and

a second switch element connected to said second connection electrode.

6. A liquid crystal display according to claim 2, further comprising:

a first conductor column provided between said first connection electrode and

said first transparent electrode;

a second conductor column provided between said second connection electrode and said second transparent electrode.

7. A liquid crystal display according to claim 6,

wherein one of said first conductor column and said second conductor column touches said pixel isolator.

8. A liquid crystal display according to claim 2,

wherein said pixel isolator has a tapered cross section.

9. A liquid crystal display according to claim 8, further comprising:

a conductor connecting between said first connection electrode and said first transparent electrode or connecting between said second connection electrode and said second transparent electrode, said conductor being provided on said pixel isolator.

10. A liquid crystal display according to claim 2,

wherein one of said first connection electrode and said second connection electrode is formed under said pixel isolator.

11. A liquid crystal display comprising:

a substrate;

a pixel electrode on said substrate;

a first connection electrode on said substrate and insulated from said pixel

electrode;

a second connection electrode on said substrate and insulated from said pixel electrode and said first connection electrode;

a first pixel isolator surrounding said pixel electrode, said first pixel isolator being formed by an insulator;

a first liquid crystal layer on said pixel electrode and surrounded by said first pixel isolator;

a first transparent electrode on said first liquid crystal layer and surrounded by said first pixel isolator, said first transparent electrode being electrically connected to said first connection electrode;

a second pixel isolator formed on said first pixel isolator;

a second liquid crystal layer on said first transparent electrode and surrounded by said second pixel isolator;

a second transparent electrode on said second liquid crystal layer and surrounded by said second pixel isolator, said second transparent electrode being electrically connected to said second connection electrode;

a third liquid crystal layer on said second transparent electrode;

a common electrode on said third liquid crystal layer; and

a counter substrate on said common electrode.

12. A liquid crystal display according to claim 11, further comprising:

a first conductor connecting between said first connection electrode and said first transparent electrode, said first conductor being provided on said first pixel isolator; and

a second conductor connecting between said second connection electrode and said second transparent electrode, said second conductor being provided on said second pixel isolator.

13. A liquid crystal display according to claim 11, further comprising:

a first conductor connecting between said first connection electrode and said first transparent electrode, said first conductor being provided on said first pixel isolator;

an insulator provided between said first pixel isolator and said second pixel isolator; and

a second conductor connecting between said second connection electrode and said second transparent electrode, said second conductor being provided on said insulator.

14. A liquid crystal display according to claim 11, further comprising an:

insulator formed between said first connection electrode and said second connection electrode.

15. A liquid crystal display comprising:

a substrate;

a pixel electrode on said substrate;

a pixel isolator isolating said pixel electrode on said substrate;

a first connection electrode on said substrate and insulated from said pixel electrode;

a second connection electrode on said substrate and insulated from said pixel electrode and said first connection electrode;

a first liquid crystal layer on said pixel electrode and isolated by said pixel isolator;

a first transparent electrode on said first liquid crystal layer and isolated by said pixel isolator, said first transparent electrode being electrically connected to said first connection electrode;

a second liquid crystal layer on said first transparent electrode and isolated by said pixel isolator;

a second transparent electrode on said second liquid crystal layer and isolated by said pixel isolator, said second transparent electrode being electrically connected to said second connection electrode;

a third liquid crystal layer on said second transparent electrode;

a common electrode on said third liquid crystal layer; and

a counter substrate on said common electrode.

16. A liquid crystal display according to claim 15, further comprising:

a conductor connecting between said first connection electrode and said first transparent electrode or connecting between said second connection electrode and said second transparent electrode, said conductor touching said pixel isolator.

17. A liquid crystal display comprising:

a substrate;

a pixel electrode on said substrate;

a pixel isolating means for isolating pixels from each other;

a first liquid crystal layer on said pixel electrode and isolated by said pixel isolating means;

a first transparent electrode on said first liquid crystal layer and isolated by said pixel isolating means;

a second liquid crystal layer on said first transparent electrode and isolated by said pixel isolating means;

a second transparent electrode on said second liquid crystal layer and isolated by said pixel isolating means;

a third liquid crystal layer on said second transparent electrode;

a common electrode on said third liquid crystal layer; and

a counter substrate on said common electrode.

18. A method for manufacturing a liquid crystal display comprising:

forming a pixel electrode, a first connection electrode and a second connection electrode on a substrate, insulated from each other;

forming a pixel isolator surrounding said pixel electrode;

forming a first liquid crystal layer in said pixel isolator and on said pixel electrode;

forming a first transparent electrode on said first liquid crystal layer, said first transparent electrode being connected to said first connection electrode;

forming a second liquid crystal layer on said first transparent electrode; and

forming a second transparent electrode on said second liquid crystal layer, said second transparent electrode being connected to said second connecting electrode.

WHAT IS CLAIMED AS NEW AND DESIRED TO BE SECURED BY LETTERSPATENT OF UNITED STATES IS:

1. A reflective display comprising:
 - a transparent first substrate;
 - a transparent first electrode formed on said first substrate;
 - a second substrate located opposite to said first substrate;
 - a second electrode formed on said second substrate;
 - partition walls dividing the display into plural cells surrounded by the partition walls, said first substrate, and said second substrate, said cells configured to be provided with an electrical bias from said first electrode and said second electrode, said partition walls slanted with respect to the first substrate and the second substrate; and
 - at least one colored particle located in at least one cell of said cells and configured to move within the at least one cell,
 - wherein a side of a part of said partition wall is observed through said first substrate under a first bias condition and the side is obscured by the at least one colored particle under a second bias condition.
2. A display according to claim 1, wherein a plurality of said cells comprises a pixel.
3. A display according to claim 1, wherein said partition walls are white.
4. A display according to claim 1, wherein said second substrate and said second electrode are transparent.
5. A display according to claim 1, wherein said first electrode is a common electrode and said second electrode is a pixel electrode.
6. A display according to claim 1, wherein said first electrode and said second

FOR INFORMATION
DISCLOSURE
PURPOSES ONLY

electrode have a striped shape, and said first electrode and said second electrode are oriented perpendicular to each other.

7. A display according to claim 1, wherein a plurality of said at least one colored particle is dispersed in a non-conductive liquid filling said cells, and a plurality of said at least one colored particle is charged.

8. A display according to claim 7, wherein said non-conductive liquid filling said cells has a color different from a color of said at least one colored particle.

9. A display according to claim 8, wherein said non-conductive liquid filling said cells has a color similar to said partition wall.

10. A display according to claim 1, wherein a plurality of said at least one colored particle is dispersed in a liquid crystal filling said cells.

11. A display according to claim 7, wherein said at least one colored particle in one of said cells has a color different from a color of said at least one colored particle in another of said cells.

12. A display according to claim 11, wherein a first group of said cells encloses at least one red colored particle, a second group of said cells encloses at least one green colored particle, and a third group of said cells encloses at least one blue colored particle.

13. A display according to claim 12, wherein a fourth group of said cells encloses at least one black colored particle.

14. A display according to claim 7, wherein one of said partition walls has a color different from another partition wall.

15. A display according to claim 1, wherein said at least one colored particle comprises:

a polymer capsule encapsulating a liquid crystal medium and capable of being transformed in shape by an application of an electric field.

16. A display according to claim 15, wherein said capsule has a color different from a color of said partition wall.

17. A display according to claim 15, wherein said liquid crystal has a color different from a color of said partition wall.

18. A display according to claim 15, wherein said cells include said at least one colored particle and a non-conductive liquid.

19. A display according to claim 18, wherein said non-conductive liquid is a liquid crystal.

20. A display according to claim 1, wherein said at least one colored particle comprises a polymer capsule encapsulating a non-conductive liquid, and said cells include said at least one colored particle comprising a polymer capsule and are filled with a liquid crystal.

21. A method for manufacturing a reflective display including a transparent first substrate, a transparent first electrode formed on said first substrate, a second substrate located opposite to said first substrate, a second electrode formed on said second substrate, partition walls dividing the display into cells, each cell of said cells surrounded by the partition walls, said first substrate, and said second substrate, and said partition walls slanted with respect to the first substrate and the second substrate, the method comprising the steps of:

forming the partition walls on the first substrate;

contacting the second substrate on said partition walls;

shifting said first substrate and said second substrate to provide said partition

walls slanted with respect to the first substrate and the second substrate;

sealing said first substrate and said second substrate; and

injecting colored particles and a non-conductive liquid between said partition walls, said first substrate, and said second substrate.

22. The method according to claim 21, wherein the step of forming partition walls on a first substrate comprises:

forming white partition walls.

23. The method according to claim 21, wherein the step of injecting comprises: injecting at least one charged colored particle.

24. The method according to claim 21, wherein the step of injecting comprises: injecting a non-conductive liquid which has a color different from a color of the colored particles.

25. The method according to claim 21, wherein the step of injecting comprises: injecting a non-conductive liquid which has a color similar to the partition walls.

26. The method according to claim 21, wherein the step of injecting comprises: injecting colored particles into one cell of said cells which have a color different from a color of colored particles in another cell.

27. The method according to claim 26, wherein the step of injecting comprises: injecting into a first group of said cells at least one red colored particle; injecting into a second group of said cells at least one green colored particle;

and

injecting into a third group of said cells at least one blue colored particle.

28. The method according to claim 27, wherein the step of injecting comprises: injecting into a fourth group of said cells at least one black colored particle.

29. The method according to claim 21, wherein the step of forming comprises:
forming partition walls with one of said partition walls having a color different from a color of other partition walls.

30. The method according to claim 21, wherein the step of injecting comprises:
injecting a polymer capsule, said polymer capsule encapsulating a liquid crystal medium and transformed in shape by an application of an electric field.

31. The method according to claim 30, wherein the step of injecting a polymer capsule comprises:

injecting a polymer capsule which has a color different from a color of said partition wall.

32. The method according to claim 30, wherein the step of injecting comprises:
injecting a liquid crystal which has a color different from a color of the partition walls.

33. The method according to claim 21, wherein the step of injecting comprises:
injecting a liquid crystal as the non-conducting liquid.